INTRODUCTION

It is well known that all Member States of the European Commission were obliged to transpose the latest Public Procurement Directives by 18 April 2016. Despite some delay, by the end of 2017 almost all EU countries have made that transposition, Portugal included.

It is also known that subsurface construction works (in particular tunnels) have some unique characteristics that demand special contractual rules for their successful completion, especially when dealing with complex geotechnical conditions.

But in most cases the public procurement rules of EU countries does not respond to these special contractual needs (Portugal included), and its rigidity makes it very difficult to manage public works properly.

Since 2008, the use of unit price contracts is forbidden in Public Works, which makes it even more difficult to have a flexible contractual tool to deal with unforeseen conditions and uncertainty, which are always present in tunnelling projects.

However, the reform of the Portuguese Public Procurement Code (PPC), which was motivated by the transposition of the new EU Directives, introduced some adjustments to the rules of modification of contracts that has brought a window of opportunity that has to be harnessed, in order to improve the contractual practices of this kind of works.

This law came into force in Portugal on January 1st, 2018. The changes to the existing law are significant and extensive, however in this article we only focus on the most relevant ones related to Subsurface Contracts for Complex Geotechnical Works, in particular tunnels.

The design by scenarios that is advocated by the Portuguese Commission on Tunnelling and Underground Space (CPT) is a compromise solution that makes it possible to take full advantage of current legislation and to move towards the implementation of best contractual practices for this kind of subsurface works in a complex geotechnical environment, as recommended by ITA and, more recently, by FIDIC, in the new Emerald Book.
2. BRIEF BACKGROUND ON THE NEW EU PUBLIC PROCUREMENT DIRECTIVES AND SUBSURFACE PROJECTS

2.1 The new EU Public Procurement Directives


EU member states have stepped up their efforts to implement those new procurement directives, and despite some delay, by the end of 2017 almost all countries (with just four exceptions) have made that transposition, Portugal included.

The 2014 EU public procurement reform pursued several objectives, in order to achieve EU strategic policy goals while ensuring the most efficient use of public funds:

i) make public spending more efficient;
ii) clarify basic notions and concepts to ensure legal certainty;
iii) make it easier for SMEs to participate in public contracts;
iv) promote integrity and equal treatment;
v) enable contracting authorities to make better use of procurement in support of innovation and common societal and environment goals; and vi) incorporate relevant case-law of the Court of Justice of the European Union.

The new Directives have introduced a number of changes and new rules in order to simplify public procurement procedures and make them more flexible.

For instance, a key aspect of the new directives concerns the article 72 of the 2014/24/EU directive (modification of contracts during their term) that clarifies in which cases contracts and framework agreements can be modified without going through a new procurement procedure, and in which cases a substantial change leads to a retendering of the contract. One example: for additional works (services or supplies which were not included in the original contract) the directive provides considerably more flexibility for contracting authorities in comparison to the previous situation of Directive 2004/18/EC, allowing for a negotiated procedure without prior publication of a contract notice under some conditions. Here, we highlight the first item:

a) “where the modifications, irrespective of their monetary value, have been provided for in the initial procurement documents in clear, precise and unequivocal review clauses, which may include price revision clauses, or options. Such clauses shall state the scope and nature of possible modifications or options as well as the conditions under which they may be used. They shall not provide for modifications or options that would alter the overall nature of the contract or the framework agreement.”.

2.2 Particularities of subsurface projects and underground works

Underground works depends on the behavior of the ground materials, and geological, hydrogeological and geotechnical ground characteristics that cannot be precisely known in the design phase. The ground characteristics have a strong influence on the means and methods required for successful implementation of subsurface projects, especially in difficult and complex geotechnical conditions.

In addition, the difficulty in predicting ground behavior and foreseeable conditions, due to several reasons like the nature of the subsurface soil conditions, heterogeneity, previous conditions of over consolidation, depth and extent of the work, etc, leads to inherent uncertainty of underground works which results in unique risks regarding construction practicability, time and cost.

Even a comprehensive subsoil investigation before the design and construction phases does not eliminate all surprises during performance of the underground construction although, in many cases, it will minimize.

For instance, tunnel design is more than a determination of the structural adequacy of component parts. It must meet practical construction requirements to secure economy and safety in a range of heterogeneous ground conditions. When an underground structure is built a redistribution of the natural initial stresses takes place. Due to this redistribution, the underground struc-
ture will be subjected to a certain level of stresses and hence loads that influences adjacent structures.

Figure 1. Design of a tunnel in Lisbon – Red Line extension of Lisbon Metro, 2008.

Recognizing these unique characteristics of subsurface projects, especially for those with longer distance and more complex soil-structure interaction like tunnels, that demand special contractual provisions and management for their successful completion, some countries with great tradition in this type of complex geotechnical works (for example, Switzerland with the Suisse Tunnel Code, and others) promote the best contractual practices with the adequacy of the construction methods initially planned to the real ground conditions and behavior found at tunnel face. For instance, by using the observational method (as set out in Chapter 2.7 of the Eurocode 7: Geotechnical Design) in which the design is reviewed during construction.

Therefore, it’s recommended the use of flexible legislative solutions adapted to this reality, which follow the best construction practices, and allow a better management of the geotechnical risk allocation.

3 THE PORTUGUESE CASE: TRANSPOSITION AND REFORM OF THE PORTUGUESE PUBLIC PROCUREMENT CODE (PPC)

In Portugal, this need for transposition has been used to proceed with a more thorough reform of the Portuguese Public Procurement Code, and took three years to complete: 2017 was the year that the Portuguese Public Procurement Code was reviewed and republished by Decreto-Lei n.º 111-B/2017. Besides the three new EU procurement directives, the Portuguese legislator also transposed into the same code the 2014/55/EU Directive on electronic invoicing in public procurement. This law came into force in Portugal on January 1st 2018.

Figure 2. Timescale for transposition of the new EU Public Procurement Directives in Portugal.
During the transposition period some public and private entities and associations in Portugal had the opportunity to contribute and express their opinion on the reform and improvement of public procurement legislation in Portugal.

Within the Portuguese Commission on Tunnelling and Underground Space (CPT) a specific working group was created; GT2 - Engineering and Legislation: Contractual Practices -, which has been working in this topic for the last 3 years and has elaborated some contributions that have been submitted to the legislator. These contributions aimed to facilitate the national legislature to access to the best contractual practices in underground construction, taking into account the rules of the new European Directives and the international experience in other countries and organizations like ITA. The most important aspects are resumed below:

i) The new directives reinforce the possibility of creating more flexible contractual arrangements, based on the rules on contract’s modification during their term. They are more open to adaptation to real ground conditions encountered during excavations in the case of complex geotechnical works, if those modifications are clearly provided for in the initial procurement documents [article 72(1)(a)]. This opens the possibility of considering different design scenarios for ground conditions and characteristics with different probability of occurrence.

ii) GT2 of CPT proposed a new type of modifications to the contract during their term, called Special Modified Works (SMW) that can occur due to modifications of the construction method on site as a consequence of the information obtained during excavations, for a scenario different than the baseline, and that can result in additional or less works (considering the baseline construction plan which was based on the most probable scenario for the expected ground conditions).

But more flexibility during construction requires accurate preparation and some conditions must be fulfilled:

iii) The modifications are performed within a Special Technical Assistance (STA) provided to the owner of the works, according to the current Portuguese Legislation (Regulation 701-H) “(...) to make the analysis of the real geological conditions ... and the assessment of the results provided by monitoring of the work ... to adapt the project to the real underground conditions.”;

iv) In the tender phase, the design should be revised by a qualified and experienced entity, distinct from its author. The revision should follow the provisions of article 43, paragraph 2 of the Portuguese Public Procurement Code and cover all of the design phases, from initial design phase until final design phase;

v) The tender documents must contain all available geological and geotechnical information, including soil investigation and classification, which is the owner’s responsibility, compiled in a geological and geotechnical information report;

vi) The baseline ground conditions, that sets out the contractual limits of the most probable conditions believed to be encountered during construction, thus providing clear distinctions in the contract documents between expected and unexpected underground conditions, sustains the design baseline scenario (scenario A), for which the excavation and construction should be designed;

vii) The design must also contain two other possible design scenarios, although with less probability of occurrence, and anticipate the construction methods and the appropriate technical solutions to respond to i) a situation with worst geotechnical conditions (scenario B) and ii) another situation with more favourable geotechnical conditions (scenario C) than the baseline scenario;

viii) The tender documents must contain "Differing Site Conditions" clauses which allocates to the owner the risk if real conditions turn out to be significantly different from expected conditions, and provides a qualitative and quantitative procedure (both financial and technical) by which the contractor can apply for and obtain an equitable adjustment for significantly unforeseen site conditions.

ix) It is advisable to implement a Dispute Resolution Board to facilitate conflict resolution during construction, with three members (as proposed, one may be appointed by the project owner, the other by the contractor and a third one appointed by both parties), technically able to analyse and act quickly as decision maker in situations of objec-
tive modifications to the contract due to changes in baseline geotechnical conditions, with respect to the national legal framework.

x) Each contract should regulate the monitoring process of the works during excavation, with periodic measures of settlements and convergences, in order to obtain real-time information about the ground behaviour and, eventually, the influence of induced subsidence on adjacent buildings (in cases of shallow tunnels in urban areas).

xi) The proposals submitted to the tender should include all the necessary works for the baseline scenario design (scenario A) and for the other two less likely scenarios (B and C). All the works will be accounted for and valued with different weights, taking into account the probability of occurrence associated with the design scenarios, as defined by the owner in the tender documents, that should use the criteria of the most economically advantageous proposal to award the contract (for guidance, owner could use a criteria for approximately 70% weighted value for the baseline scenario A and 15% weighted value for the other scenarios B and C);

xii) It is advisable the inclusion of Project Management techniques, in particular those related to formal risk management procedures, covering all the parties involved and all stages of the design (from feasibility studies to final design). It’s a systematic approach used as a tool to manage and mitigate identified risks, anticipate scenarios and support the decision making.

The figure below resumes the arguments and the proposed solution:

![Figure 3. Puzzle – from the GT2 contribution to the revision of the Portuguese PPC, 2016.](image)

The changes to the Portuguese law are significant and extensive. To give an idea of the extension of the revision, more than 50% of the almost 500 articles of the code were adjusted, eliminated or added.

Some of the contribution were considered, some weren’t. In the next chapter we will cover the most important contributions for subsurface projects.

Of course, there is no consensual position between all stakeholders, about the benefits and disadvantages of the new Portuguese Public Procurement legislation: it is far too comprehensive (the public entities can buy a pen or build a giant tunnel with the same Code) some say, or it is very specific and rigid say others. One thing is certain, though: it is with this law, this contractual tool, that we will have to manage the Portuguese public works in the next few years, and we’ll have to take the best of it (despite trying to continue to change and improve the law).
4 WINDOW OF OPPORTUNITY: CHANGES AND IMPACT FOR SUBSURFACE CONSTRUCTION CONTRACTS (ESPECIALLY FOR TUNNELS)

Taking into account the importance of this revision and the impact on Portuguese subsurface public works with strong geotechnical complexity, a brief summary of the changes that impacts directly the design, tender, execution and risk management of subsurface works (especially for tunnels) is presented.

1. Objective modification of contracts, which can now be carried out "on the basis of the conditions set out therein ..." [Articles 312 to 315];

   The novelty of the new wording of Article 312 appears at the beginning of the article: "The contract may be modified on the basis of the conditions set out therein and further ..."

   This new justification for the existence of an objective modification of the contract during the construction period transposes into national legislation the assumptions referred to in Article 72 (1) (a) of Directive 2014/24/EU. These recognize the importance of contractual flexibility in order to achieve the objectives of a public contract by accepting the possibility of modifying the contract provided that they have been duly indicated in the procedure.

   This novelty opens the possibility of adopting a design methodology based on the prediction of a scenario of reference (more probable) and two other alternative scenarios (less probable) for construction period, capable of giving a more comprehensive and adaptable response to the situations encountered in accordance with the state of art rules and proper risk management.

   This was one of the measures that Working Group N.2 of the Portuguese Commission on Tunnelling and Underground Space proposed to the government, in the context of the contributions submitted in 2016, in order to respond to predictably uncertain situations occurring in this type of geotechnical complex works. Such measures require a justified adaptation of the construction method due to substantially different geotechnical conditions from those foreseen in the design baseline scenario.

   A very relevant aspect in this type of works that has to be considered is the risk sharing between the parties (as referred in Article 314 (3)), which must be very well defined in the tender documents. For example, another proposal submitted by the WG2 of CPT relates to the allocation of the hydrogeological and geotechnical risk to the owner, while the risk of performance for the expected geotechnical conditions must be assigned to the contractor.

2. New regime of "additional works" and "errors and omissions" on the contract formation stage - introduction of "complementary work" [Articles 61 and 370 to 378];

   With the introduction of a new type of work, called "complementary work", the legislator drops the concept of "additional work" (typically associated with works not foreseen in the contract due to unforeseen circumstances) and "errors and omissions" (typically associated with works: i) resulting from situations that are not consistent with reality but could and should have been foreseen, or ii) resulting from situations associated with natural constraints with special characteristics of unpredictability such as complex geotechnical works) and broadens the spectrum of circumstances associated with these new complementary work:

   (i) "(...) where they result from unforeseen circumstances (...)", their cumulative value does not exceed 10% of the contractual price;

   (ii) "(...) where (...) they result from unforeseeable circumstances or which a diligent contracting authority could not have anticipated (...)", their aggregate value does not exceed 40% of the contractual price.

   These changes do not respond to the circumstances of predictably uncertain situations, where the owner (or his consultant) cannot accurately predict the actual site conditions (despite having been diligent in the preparation of the tender), but can predict that there may be different situations than those indicated in the project.

3. Alternative dispute resolution through the use of arbitration [Article 476]

   The new Article 476 of the Portuguese PPC authorizes the use of arbitration or other means of alternative dispute resolution arising from procedures or contracts. But such a
response may not be the most adequate for an expedited resolution of conflicts during the execution of subsurface projects and underground works.

As proposed, for underground construction with high uncertainty potential, there should be implemented a Conflict Resolution Commission with three members (technical experts, one appointed by the Owner of Work, the other by the Constructor and a third named by these two members) capable of technically analyse the situations and to act quickly as a decision maker in situations of objective modifications to the contract due to changes in the initially predicted geotechnical conditions, always respecting the applicable legal regime.

This measure was presented to the government in the 2016 contributions indicated above. Many other amendments have been introduced in the Code but, as regards to tunnels and complex subsurface works, the most important is to answer the following question:

When uncertainty is certain, what’s the right thing to do?

In Portugal, with the recent reform of the Public Procurement Code, the solution is to carry out design for several scenarios, that should take into account the most probable conditions and also other unfavorable conditions (or more favorable) that might occur during construction. Therefore, the design should be done for different scenarios and design options should be updated to be adapted to the real ground conditions.

To resume, some of the adjustments in the law might have opened a “window of opportunity” in Portugal (and perhaps in other EU countries?) so that we have a legislative solution that:

i) meets the objectives of the new European Directives on Public Procurement;

ii) is more prone to the best construction practices of subsurface projects (taking into account ITA’s recommendations) for high complexity underground works with uncertainty; and thus

iii) allow better risk management (in particular, the geotechnical risk) and

iv) will lead to best value for money management and increased safety of these complex geotechnical public works;

and we have to take it!

5 APPLICATION OF ITA’S CONTRACTUAL FRAMEWORK CHECKLIST FOR SUBSURFACE CONSTRUCTION CONTRACTS IN PORTUGAL: LIMITATIONS AND OPPORTUNITIES

The International Tunnelling and Underground Space Association (ITA) has already prepared Guidelines and Recommendations on Contractual Aspects of Conventional Tunnelling (WG19) and Contractual Framework Checklist for Subsurface Construction Contracts (WG3), that resumes the state of art for contractual purposes on subsurface projects (the revised version of Contractual Framework Checklist will be released for the WTC2019 in Naples by WG3 of ITA).

Also, ITA is working together with FIDIC (TG10) in order to propose a new FIDIC Form of Contract for Tunnelling and Underground Works – The Emerald Book. The motivation for this task group is very well resumed by FIDIC: “There can be no doubt that subsurface construction projects require specialist contractual frameworks. Within these contractual frameworks, it is of paramount importance to manage the risks specific to underground projects such as uncertainties regarding the geological, geotechnical and structural performance of the subsurface space”.

Both documents will be released soon, and they highlight the importance of promoting equitable risk allocation and the effective dealing with unforeseen conditions in complex subsurface projects.

In this chapter we highlight just two of the most important recommendations, knowing that this subject has already been addressed in the contributions proposed by the CPT in 2016:

1. Allocation of risk:

The ground and groundwater related risks should be assigned to the Owner, as the party who will most benefit from the completed project and as the party that can best control
these risks (he is the only one that can decide to move to another location). The performance related risk arising from expected ground conditions should be assigned to the Contractor.

2. Provisions of a flexible mechanism for remuneration according to ground conditions, foreseen and unforeseen:

A unit price contract payment system for items that are affected by ground and groundwater conditions should be used. The unit price structure should be organized to facilitate the distinction between fixed costs, time-related costs, value-related costs and quality-related costs.

The difficulty is in applying these principles and recommendations in Portugal, taking into account the new revised Code: the use of unit price contract is prohibited and risk management is neither mandatory nor widespread as it should.

But we will keep trying to move towards the best contractual practices for underground works, specially for tunnel projects.

6 CONCLUSIONS

This article appears in a period of transition to the "new" national legislation on public procurement, in Portugal and also in the other EU countries, due to the necessary transposition of the public procurement Directives. It will require an adaptation of all the stakeholders and, hopefully, an improvement of the contractual practices of this type of complex underground geotechnical works, especially the tunnels.

For these subsurface projects with underground works we advocate, on the one hand, greater contractual flexibility during the construction phase, but also, on the other hand, a greater rigor in the design and preparation phase of the tender.

There are several recommendations that should be followed, but we highlight the project for several scenarios, that makes it possible to take full advantage of current legislation in Portugal and to move towards the implementation of best contractual practices for this kind of subsurface works: if we can’t use unit price contracts, we can use a “scenario” price contract!

The contributions from GT2 of CPT are summarized in the figure below:

![Table and Diagram]

Figure 4. Several measures from GT2 contribution to the revision of the Portuguese PPC, 2016.

In conclusion, with this article we would like to i) contribute to achieve a better understanding of the legislative changes due to the new EU Directives, and their impact into the Portuguese Public Procurement Code that have great influence on the execution of complex geotechnical works; ii) as well as to spread the best international practices in this type of works, mainly in terms of management and risk sharing and alternative conflict resolution procedures.
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8 REFERENCES


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